

## REVIEW

## ACCREDITATION OF ANALYTICAL LABORATORIES AND PROFICIENCY TESTING: EXPERIENCES FROM THAILAND ON THE ISSUES OF PESTICIDE ANALYSIS

AMARA VONGBUDDHAPITAK<sup>1</sup>, SUMOL PAVITTRANON<sup>1</sup>, NUANSRI TAYAPUTCH<sup>2</sup>, SOMCHAI ISSARAVANICH<sup>3</sup>, AND PALARP SINHA SENI<sup>3</sup>

*Department of Medical Sciences, Ministry of Public Health, Bangkok<sup>1</sup>, Department of Agriculture, Ministry of Agriculture, Bangkok<sup>2</sup>, Institute of Health Research, Chulalongkorn University, Bangkok<sup>3</sup>, Thailand*

Received November 1998

Thailand, the economic growth of which largely depends on agriculture-based industry, recognizes the importance of international standards for harmonization of international food trade and for protection of human health from chemicals used as food additives or those present as contaminants. Pesticides which are widely used in Thailand are the anticholinesterase pesticides, pyrethroids, coumarin derivatives, bi-pyridinium salts, and to some extent organochlorine compounds such as DDT in malaria control.

Proficiency testing and accreditation of laboratories are recognized as effective means to ensure quality and validity of data and to enable adequate risk assessment of pesticide residues in food, work environment and environment in general. The paper is a synthesis of relevant local reviews and in-depth interviews with experts in the area of pesticide laboratory accreditation and proficiency testing. The paper refers to other schemes for quality assurance such as ISO guide 25, ISO 9000, and ISO 14000, and addresses future prospects of ongoing activities such as accreditation of inspection bodies in the area of industrial chemicals and occupational safety and health.

*Key words:*

food additives, food contaminants, formulation analysis, oxytetracycline, quality assurance

The agricultural sector is very important to Thailand as a source of export revenue and a part of a strategy to alleviate poverty through employment and subsistence. As much as 44.6% of the total area (513,115 km<sup>2</sup>) is employed in agricultural production.

Pesticides are used in Thailand as the main tool for pest control. According to Agricultural Regulatory Division, Thailand imported 29,463 tons of pesticides in 1990. Of the total imports, herbicides constituted approximately 50%, insecticides 31.8%,

whereas fungicides and miscellaneous pesticides constituted the rest. The intensity of pesticide application in vegetable and fruit production is higher than in other crops. The Thai pesticide market is considered rather liberal. The import and the sale of pesticides are handled mostly by the private sector.

The acceptance of the ISO 9000 series of Quality Management Standards increased the interest in the application of the preceding ISO/IEC guide 25 for the Quality Management System within a laboratory environment (1). In Thailand, regulatory authorities have operated some form of laboratory assessment to establish the competence of testing laboratories for their specific purpose. However, the formal systematic process defined by the International Organisation for Standardization (ISO) and the International Laboratory Accreditation Conferences (ILAC) have not been incorporated in the system.

## OBJECTIVES OF THE REVIEW

The aim of this study was to synthesize the relevant local literature data and in-depth interviews with experts in the area of pesticide laboratory accreditation and proficiency testing and to discuss proficiency testing activities in the area of pesticide analysis in Thailand in view of future development and possible collaboration with other countries.

Reviews and expert data are meant to show the history and approaches to laboratory accreditation with special reference to pesticide analysis in Thailand. Expert opinion helped formulate recommendations and expectations as to the future of proficiency testing and accreditation of laboratories in Thailand.

## RESULTS

Many government agencies actively involved in the analysis of food products for export function as certifying bodies for various private companies dealing with the analysis of chemical contaminants. The Toxic Substance Control Division, Department of Agriculture carries out a contract laboratory program for pesticide product formulation analysis. The Division has accredited seventeen private analytical laboratories for the purpose. Similarly, the Veterinary Public Health Division, Livestock Department, Ministry of Agriculture and Cooperatives operates a proficiency testing loop with ten export companies in the area of food contaminants.

The Department of Medical Sciences (DMSc), Ministry of Public Health, acts as a regulatory body for the Food and Drug Administration of Thailand. DMSc maintains large multidisciplinary laboratories and provides services which cover the analysis of locally manufactured, imported, or exported consumer goods that may affect human health. The analyses of forensic samples, narcotics, and environmental samples are

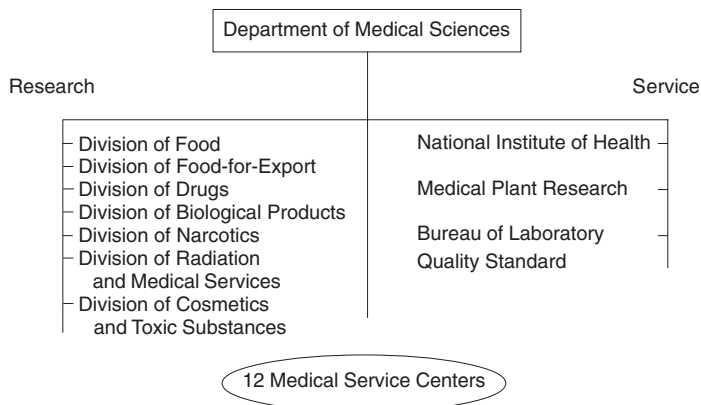


Figure 1 *Structure of the Department of Medical Sciences (DMSc)*

also performed. Other laboratories assist the National Institute of Health, focusing their research on infectious and non-infectious diseases to provide data supporting health planning. Figure 1 shows DMSc's technical organisation.

Proficiency testing and accreditation of laboratories are recognized as effective means to ensure quality and validity of data. Thailand, the economy of which substantially depends on agriculture-based industry, recognizes the importance of international standards which are meant to harmonize international food trade and provide health protection from chemicals used as food additives or present in food as contaminants.

DMSc routinely monitors pesticide residues in food and pesticide intake. A screening test kit for organophosphate and carbamate residues in food and vegetables has been developed and transferred to the agricultural sector to monitor residues in the harvest areas. The department has participated in the WHO proficiency testing for more than 10 years.

The QA Program was approved by DMSc DG in November 1992. Thirteen senior scientists were appointed to the DMSc Quality Assurance Committee (QAC). Since then the program has been recognized and has received priority by the ministry. The first draft of a QA manual in Thai appeared in May 1993. In September of the same year, the US EPA kindly offered assistance to DMSc to redesign the system and develop the manual to conform with the international requirements. The manual was completed in December 1993 under the name QAMM. The QA system was officially implemented in September 1994. In 1995, additional activities specified in QAMM were carried out in the area of both chemical and microbiological testing, such as revision of QAMM and of the Technical System Audit (TSA) at the condom testing laboratory. The QA implementation group in clinical and research labs has been appointed to extend the system to the whole department and the QA office was established the same year.

Beside laboratory accreditation, DMSc issues pre-export certificates for food through its Division of Food-for-Export. Figure 2 flow chart shows the certification procedure.

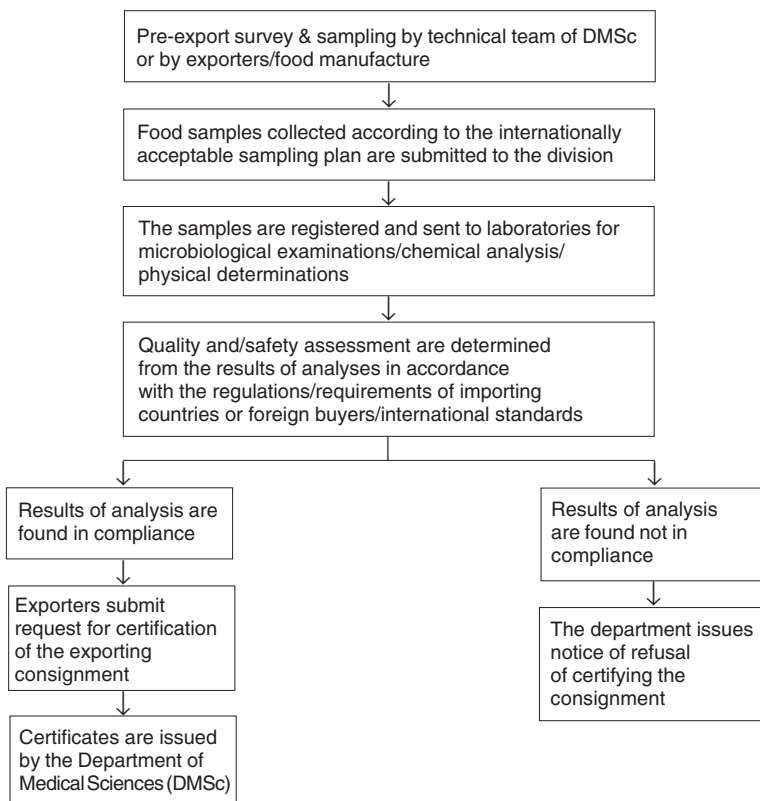


Figure 2 *DMSc export food consignment certification procedure*

As the Thai laboratories for pesticide residue analysis presently fall short of required modern equipment, no laboratory has yet received relevant accreditation.

Beside the DMSc, other organisations issue export food certificates, each according to its competence. Thus, Veterinary Public Health Division of the Ministry of Agriculture and Cooperatives issues export food certificates after receiving analyses of water, meat, meat products, and canned food. This relates to microbiological findings, some pesticide and drug residues, trace elements, and parasites.

Further, Toxic Substance Division of the Ministry of Agriculture and Cooperatives issues certificates upon analysis of different formulations of 116 pesticides imported, formulated, or used in the country.

Agricultural Chemistry Division of the Ministry of Agriculture and Cooperatives analyses and issues certificates for a number of required microbiological analyses of food, including quantities of natural food constituents as well as food additives and contaminants.

International accreditation systems such as the ISO 9000, ISO 14000, training courses, and auditor registration, as well as laboratory accreditation are recognized through mutual recognition agreement (Figure 3).

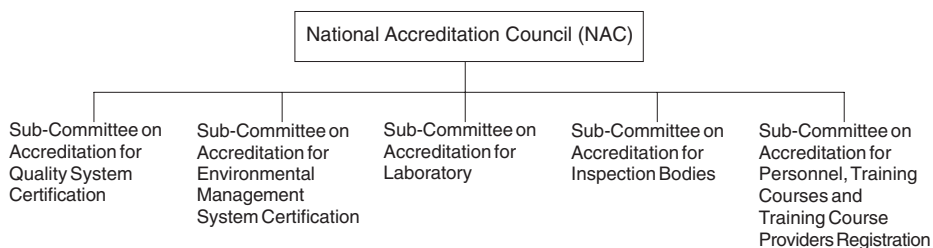


Figure 3 *Sub-Committees of the National Accreditation Council (NAC)*

Proficiency testing and the accreditation system recognized in Thailand in various government agencies are summarized in Table 1.

Table 1 *Examples of proficiency testing activities international mutual recognition in various government agencies in Thailand involved in pesticide analysis*

Responsible Agencies	Pesticides	Proficiency Testing*	Accreditation Scheme
<b>Ministry of Agriculture and Cooperatives</b>			
- Livestock Department Veterinary Public Health Division	Organochlorine in fat tissue for export commodities	FAPAS	NAC guide 25 certification.
- Department of Agriculture Toxic Substance Control Division	Organochlorine (OC), organophosphates (OP), carbamates, and pyrethroids in export/import commodities as well as environmental samples	AQAS (GTZ) ACSL	NAC guide 25 certification is being sought.
<b>Ministry of Public Health</b>			
- Department of Medical Sciences Food Analysis Division	Local consumption as well as import/export commodities. OC, OP, pyrethroids	AQAS (GTZ) NARL	ISO guide 25 certification is being sought.
Food Export Division	OC in food and vegetables	FAPAS	Assisted by JICA** for method validation.
- Department of Health Environmental Health Division	OC in environment	NATA	NAC guide 25 certification is being sought.

\* FAPAS – Food Analysis Performance Assessment Scheme; England  
 AQAS (GTZ) – Analytical Quality Assurance Scheme; Germany  
 ACSL – Australian Chemical Standard Laboratory; Australia  
 NARL – National Analytical Reference Laboratory; Australia  
 NATA – National Association Testing Authority; Australia

\*\* JICA – Japan International Cooperation Agency

## DISCUSSION

The purpose of most activities related to proficiency testing in Thailand is to ensure harmonization and international recognition in the area of pesticide residues in food. The government participation in proficiency testing has enabled quality assurance of the data obtained from periodic monitoring of the local food supply and specific export food such as frozen chicken for the EU countries. However, it is generally recognized that the proficiency testing activities in the area of pesticide analysis in Thailand have not fully been carried out.

Difficulties have been experienced and reported in several areas. Having adopted mutual recognition agreement such as international standards ISO guide 25 and ISO 14000, which are presented in English language, the national accreditation scheme encountered limited participation and possible misinterpretation of specific terms. Data collection in Thailand is not systematic at present and national document archives are not comprehensive.

Proficiency testing which will enhance the data quality assurance in the area of pesticide analysis exists for organochlorine analysis in food commodities such as frozen chicken through the cooperation of export companies with the Veterinary Public Health Division of the Ministry of Agriculture and Cooperatives. All other forms of proficiency testing are carried out through international agencies. It is evident that these activities should increase in number and scope both for home market and for the export.

Standard methods which are used for specific purposes such as the establishment of international MRLs for international food standards such as FAO/WHO Codex system (2–4) need to meet certain criteria. Thailand has had experience in successful completion of the proposal for validation of methods of analysis of oxytetracycline in giant prawn (5). However, the efforts clearly showed the following points needed improvement:

- Availability of standard reference materials as well as standard chemicals and traceability documents provided by chemical companies for the validation of selected methods.
- Availability of calibration services, substantiated by a study assessing the needs of 31 food export firms in Thailand (6). The calibration and maintenance services for instruments, as well as those for computer software (calculations, databases) are not sufficient.
- Involvement in collaborative studies in order to test the performance characteristics of methods being considered and achieve higher harmonization between different laboratories in Thailand and abroad.

## REFERENCES

1. *International Organisation for Standardization (ISO) and International Electrotechnical Commission (IEC)*. Guide 25: General requirements for the competence of calibration and testing laboratories. Third edition. Geneva: ISO/IEC, 1990.

2. *Food and Agriculture Organisation (FAO) and World Health Organisation (WHO)*. Codex Alimentarius Commission: Status of codex maximum limits for pesticide residues in foods and animal feeds. Rome: FAO, 1994.
3. *Food and Agriculture Organisation (FAO) and World Health Organisation (WHO)*. Codex Alimentarius Commission: Residues of pesticides in foods and animal feeds. Rome: FAO, 1996.
4. *Food and Agriculture Organisation (FAO) and World Health Organisation (WHO)*. Codex Alimentarius Commission: Residues of pesticides in foods and animal feeds. Rome: FAO, 1997.
5. *Food and Agriculture Organisation (FAO) and World Health Organisation (WHO)*. Residues of some veterinary drugs in animals and foods. *FAO Food and Nutrition Paper*, 1997;41:75–6.
6. *Sinhaseni P.* Needs assessment of Thai food export industry pertaining to GATT's agreements on the sanitary and phytosanitary measures (abstract). In: Technical Conference 12<sup>th</sup>. Bangkok: Faculty of Pharmaceutical Sciences, Chulalongkorn University, 1995.

### Sažetak

## AKREDITACIJA ANALITIČKIH LABORATORIJA I PROVJERA VRSNOSTI RADA: ISKUSTVA TAJLANDA U SVEZI S ANALIZOM PESTICIDA

Ekonomski rast Tajlanda usko je vezan s proizvodnjom oslonjenom na poljoprivredu. Stoga ova zemlja pridaje veliku važnost međunarodnim normama koje usklađuju međunarodni promet hrane i štite zdravlje potrošača od kemikalija bilo u obliku aditiva ili kao onečišćivala (engl. *contaminant*). U Tajlandu su u širokoj primjeni antikolinesterazni i piretroidni pesticidi, derivati kumarina, soli bi-piridinija te donekle organoklorirani spojevi kao što je DDT koji se rabi za kontrolu malarije.

Testiranje vrsnosti i akreditacija laboratorija mogu učinkovito osigurati kakvoću i pouzdanost podataka te omogućiti kvalitetnu procjenu rizika od ostataka pesticida u hrani i okolišu. Članak objedinjuje važnu tajlandsku literaturu o testiranju vrsnosti i akreditaciji laboratorija za analizu pesticida te upućuje na druge postojeće sheme za osiguranje kakvoće kao što je ISO guide 25, ISO 9000 i ISO 14000. Autori se također bave budućnošću aktualnih aktivnosti kao što su akreditacija inspeksijskih tijela na području industrijskih kemikalija te zaštite na radu i medicine rada.

#### Ključne riječi:

aditivi, oksitetraciklin, onečišćivala, osiguranje kakvoće

Requests for reprints:

Somchai Issaravanich  
Institute of Health Research, Chulalongkorn University  
Phyathai Road, Bangkok 10330, Thailand  
E-mail: [isomchai@netser.chula.ac.th](mailto:isomchai@netser.chula.ac.th)